

Delab 1. Process for manufacturing a composite tape (10) based on reinforcing fibres and on a thermoplastic organic material, consisting in bringing together and in consolidating a multiplicity of continuous yarns (11), **characterized in that:**

- 10 - yarns (11) based on thermoplastic and reinforcing fibres are entrained and brought together in a parallel manner in the form of a sheet (12);
- 15 - the said sheet (12) is made to enter a zone in which it is heated to a temperature reaching at least the melting point of the thermoplastic without reaching the softening temperature of the reinforcing fibres;
- 20 - the sheet (12) is made to pass through a rotating impregnation device (80), while maintaining its temperature at a temperature at which the thermoplastic is malleable, in order to distribute the molten thermoplastic uniformly and guarantee that the reinforcing fibres are completely impregnated by the latter;
- 25 - the sheet (12) is introduced into a shaping and centring device (100), while maintaining its temperature at a temperature at which the thermoplastic is malleable, so as to obtain a tape (13) formed by bringing the yarns (11) together so as to be touching, thereby creating transverse continuity;
- 30 - the tape (13) is cooled in order to consolidate the yarns by freezing the thermoplastic and its dimensional characteristics and its appearance are set in order to deliver the said composite tape (10).

35 2. Process according to Claim 1, **characterized in that** the yarns (11) that are brought together

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consist of continuous glass filaments and continuous thermoplastic filaments which are co-mingled.

Sub B2 → 3. Process according to Claim 1 ~~or 2~~, **characterized in that** it consists in unreeling, from 5 wound packages, a continuous yarn of reinforcing filaments and thermoplastic filaments and, while the yarns are being brought together in the form of a sheet, in regulating the tension in the yarns.

4. Process according to claim 1, **characterized** 10 **in that** the yarns ~~(11)~~ are stripped of any static electricity before the sheet ~~(12)~~ passes into the heating zone.

5. Process according to Claim 1, **characterized** **in that** the sheet ~~(12)~~ is introduced into an additional 15 heating zone after it has passed through the rotating impregnation device ~~(80)~~.

Sub B3 → 6. Process according to Claim 1, **characterized** **in that**, at the end of the manufacturing line, the tape ~~(10)~~ is wound up in the form of a reel for storing it.

Sub A4 → 7. Apparatus for implementing the process 20 according to any one of Claims 1 to 6, **characterized in that** it comprises:

- 25 - means (130) for entraining the continuous yarns (11) consisting of reinforcing filaments and of thermoplastic filaments and means (50) for bringing the said continuous yarns into the form of a sheet (12);
- 30 - means (70) for heating the said sheet (12) to a temperature reaching at least the melting point of the thermoplastic but not the softening temperature of the reinforcing filaments;
- 35 - a rotating device (80) for impregnating the heated sheet so as to distribute the molten thermoplastic uniformly and guarantee that the reinforcing filaments are completely impregnated by the latter;
- a device (100) for shaping and centring the sheet (12) so as to convert it into a tape (13);

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See
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claim

- a calender (110) for cooling the tape (13), making it possible to freeze the thermoplastic and to consolidate the yarns (11) and form the final tape (10).

5 8. Apparatus according to Claim 7, **characterized in that** it comprises additional heating means ~~(90)~~ so as to keep the thermoplastic of the sheet ~~(12)~~ malleable after the latter has passed through the impregnation device ~~(80)~~.

10 9. Apparatus according to Claim 8, **characterized in that** the two heating means ~~(70, 90)~~ are ovens.

15 10. Apparatus according to Claim 7, **characterized in that** the means ~~(50)~~ for bringing the yarns together consist of a comb, the tines ~~(51)~~ of which produce a uniformly-spaced parallel alignment of the yarns ~~(11)~~.

20 11. Apparatus according to Claim 7, **characterized in that** the impregnation device ~~(80)~~ comprises three heated rotating rolls ~~(81)~~ which are arranged in a triangular configuration and between which the sheet ~~(12)~~ runs, the roll separation height being adapted in order to apply suitable pressure to the surface of the sheet.

25 12. Apparatus according to Claim 11, **characterized in that** each roll ~~(81)~~ has a blade ~~(82)~~ for scraping off the molten thermoplastic deposited on the roll after the sheet has passed.

30 13. Apparatus according to Claim 7, **characterized in that** the shaping and centring device ~~(100)~~ comprises a lower roller ~~(101)~~ and an upper roller ~~(102)~~ which are offset, one above the other, and rotating in opposite directions, the upper roller being in the form of a hyperboloid, and the sheet ~~(12)~~ being concentrated around the central running axis as it passes between the two rollers in order to deliver a tape ~~(13)~~
35 constituting a mutually contiguous association of yarns.

14. Apparatus according to Claim 7, **characterized in that** the cooling calender ~~(110)~~ consists of two rotating cooling rolls which are arranged one above the

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other and between which the tape ~~(13)~~ runs and which do not have guiding edges, the calender giving the composite tape ~~(10)~~ its final shape.

5 15. Apparatus according to Claim 14, **characterized in that** the cooling calender ~~(110)~~ includes, downstream of the rolls, a bath ~~(120)~~ in which the running composite final tape ~~(10)~~ is immersed.

10 16. Apparatus according to Claim 7, **characterized in that** means ~~(40)~~ for regulating the tension in the yarns ~~(11)~~ are provided upstream of the means ~~(50)~~ for bringing the yarns together.

15 17. Apparatus according to Claim 7, **characterized in that** an antistatic device is provided upstream of the heating means ~~(70)~~.

20 18. Apparatus according to Claim 7, **characterized in that** it includes, at the end of the manufacturing line and downstream of the entrainment means ~~(130)~~, a winder ~~(140)~~ allowing the tape ~~(10)~~ to be wound in the form of a reel.

25 19. Tape obtained according to the process of Claim 1, **characterized in that** it constitutes a strong flexible product of smooth surface appearance, having a thickness of less than 0.2 mm and a void content of less than 0.2%.

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